Infiltration of Sports Science Knowledge Based on Biological Health Education in Secondary Schools

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Abstract: Health education is related to improving health awareness and literacy of all people, and its status is becoming increasingly prominent in the background of the educational concept of health first advocated by China. Biology is rich in health education resources due to its subject content and characteristics, but the value of health education in secondary school biology teaching needs to be deepened. In this paper, the necessity of health education in secondary school biology curriculum is elaborated from the curriculum standard and core qualities of the discipline, and the implementation of health education in secondary school biology teaching is explored with the strategy of infiltrating the knowledge of sports science and health care. By analyzing the biology textbooks of junior and senior high schools of the Humanistic Education Edition, the paper summarizes the knowledge of sports science and health care in the teaching resources of the secondary school biology curriculum. It takes Hormones and the endocrine system as an example to reflect the infiltration of sports science knowledge in teaching.

***Keywords*:** secondary school biology; health education; physical education

1. Introduction

Civilised in spirit, barbaric in the body from Mao Zedong's The Study of Sports [1] is now once again quoted by General Secretary Xi in his earnest message to children and young people's all-round development and healthy growth [2] and reaffirms the educational concept of health first. In recent years, China has focused on the comprehensive development of children and youth and health education. The Ministry of Education has issued a series of program documents, such as the Guidelines for Primary and Secondary School Health Education [3], to guide the improvement of the education system to implement the educational objectives of promoting morality and nurturing people and five education. The program clearly states that health education in secondary school should be organically integrated with teaching biology and other subjects and that students should be taught health knowledge and skills in various forms. As a natural science that studies the phenomena and laws of life, biology is rich in health education value due to the subject's characteristics.

In the essential education stage, the primary carrier of health education in China is Physical Education and Health. The implementation of health education is generally in a single form, and the value of health education in secondary school biology teaching needs to be deepened. The five education and comprehensive education concern not only the national education strategy but also the students' physical and mental development and personal growth. Because there are few studies on health education in secondary school biology teaching, this paper analyses the necessity of health education in secondary school biology teaching from the dimensions of curriculum standards and disciplinary core literacy. It explores the practical landing point and curriculum mode of implementing health education in secondary school biology by using the infiltration of physical education and scientific knowledge to provide references for most frontline biology teachers to implement health education in the teaching process. This provides a reference for most first-line biology teachers to implement health education in the actual teaching process.

2. The need for the teaching of biology in secondary schools to fulfill the value of health education

2.1 Health Education as a Requirement of Biology Content and Curriculum Standards

The Biology Curriculum Standards for Compulsory Education divide the content of the junior high school biology curriculum into ten first-level themes, of which 'living a healthy life' is one. The standards point out that teachers need to help students construct essential concepts related to adolescent physiology and health care, infectious diseases and immunity, and

general knowledge of medicine. The teaching content of this theme is consistent with the Guidelines for Health Education in Primary and Secondary Schools, which point out that health education includes healthy behaviors and lifestyles, disease prevention, growth and development, and puberty care.

The Biology Curriculum Standard for General High Schools also proposes Healthy Life as a module related to real-life applications and suggests that teachers should make it clear that health education is an important part of the cultivation of qualified citizens, and a basic component of the implementation of quality education. and put forward the requirement for teachers to make it clear that health education is an integral part of training qualified citizens and an essential part of implementing quality education. It can be seen that mastering and applying biological knowledge is the critical methodology for citizens to identify pseudoscience and choose a healthy lifestyle. Implementing health education is an essential requirement of the secondary school biology curriculum standards and an inherent need for the content of the biology subject.

2.2 Health Literacy is embedded in the Core Biology Literacy

Health literacy refers to an individual's ability to obtain, understand, and apply basic health information and services to make correct decisions to safeguard and enhance their health, which includes basic health knowledge and concepts, healthy lifestyles and behaviors, as well as basic skills to maintain and promote health [4]. The core qualities of the discipline are the embodiment of the humanistic value of the biology discipline and cultivating students to establish a sense of health and use the theoretical knowledge of biology to guide a healthy life is also one of the humanistic values of the biology discipline, so it can be seen that health literacy and the core qualities of the biology discipline are in the same vein. Social responsibility stresses that students can make rational interpretations and judgments on their personal life and social things based on their knowledge of biology, and advocating a healthy and civilized lifestyle, and becoming a promoter and practitioner of a healthy China is one of the essential contents, which is an integral part of health literacy in the core literacy of the discipline. This is the primary manifestation of health literacy in the core literacy of the discipline. The concept of life is the key and symbol of core literacy [5], in which the construction of structure and function, matter and energy, homeostasis and equilibrium needs to be supported by some of the critical facts and evidence of biology related to the knowledge of sports science, nutrition, and life health care. Knowledge and skills are the carriers of literacy enhancement. While students construct the concept of life, enhancing health literacy is inevitable, i.e., by learning relevant concepts, students can form the idea of a healthy life and guide their behaviors to achieve the unity of ‘knowledge, emotion, intention, and action.’

3. Deepening health education in secondary school biology teaching with the penetration of sports science knowledge

To cultivate students health literacy in secondary school biology classrooms, it is an effective strategy to closely match the students actual needs in life and organically penetrate the sports science knowledge and daily health care knowledge related to the teaching content in the teaching link. The integration of sports science knowledge can help to create a living teaching situation, enhance the practicality of classroom knowledge, and increase students interest in learning, which not only realizes the integration of physical education and sports but also facilitates students understanding, internalization, and transfer of biological concepts. Taking the biology textbooks of the Humanistic Teaching Edition of junior high school and senior high school as examples, the intersections between the biology curriculum resources and the knowledge of sports science and health care are sorted out and presented as a table (see Tables 1 and 2).

4. Teaching process of infiltration of sports science knowledge on the example of hormones and endocrine system.

4.1 Present background information to create an interdisciplinary context

Teacher behavior: After a preliminary explanation of the concepts related to hormone regulation, show typical cases related to doping at the Tokyo 2020 Olympic Games (e.g., arbitration of the Russian delegation due to the doping incident, methods of detecting doping at the Tokyo Olympic Games), and ask the students whether they understand the role of doping in sports events.

Students' behavior: Summarise that the effects of doping include making athletes feel less tired during endurance sports, speeding up athletes' muscle growth, increasing the speed of sports, diuresis, etc.

4.2 Return to the concepts of teaching materials and solve related problems

Teacher behavior: Explain the main types of stimulants, e.g., endogenous peptide hormones, anabolic steroids (mostly androgen derivatives), and sympathomimetic amines. Show the case of Heidi Glick, a German shot putter who

Table 1. Intersection of junior high school biology teaching content with sports science and health care knowledge (based on the textbook of the Humanistic Education Edition as an example)

Level 1 Themes	Chapter	Teaching and Learning	The intersection of Sports Science and Health Literacy	Health Education Objectives
Living Healthily	Adolescence	Adolescence is the prime time in your life for physical and intellectual development.	Nutrition and exercise during puberty are essential factors in building a solid body.	Understand the importance of a healthy and civilized lifestyle.
	Nutrients in food	Acquire basic general knowledge of functional and health foods.	Characteristics of sports functional drinks, how to choose sports functional beverages.	Acquire a basic general understanding of functional and health foods.
		Proteins are essential materials for building and repairing the body and can also provide energy for the human body.	Athletes choose high-protein diets in endurance sports because of protein powder's functions, side effects, and the suitable target groups.	Understand the importance of appropriate meat, eggs, and dairy supplementation during adolescence, and avoid unthinkingly purchasing protein powder.
People in the Biosphere	Gas exchange occurs in the lungs.	Air from the external environment enters the lungs through the respiratory tract, where gas exchange occurs between the lungs and the blood。	Characteristics of aerobic exercise: The positive effects of scientifically-regulated aerobic exercise on the respiratory system.	Understand the relationship between physical exercise and the respiratory system.
	The pump that carries blood - the heart	The heart's structure and function, along with the blood circulation pathways.	The meaning of cardiorespiratory function, and the ways and significance of exercising cardiorespiratory function in adolescents.	Master cardiovascular health knowledge during adolescence.
	Components of the Nervous System	The nervous system consists of the brain, spinal cord, and the nerves emanating from them.	Warm-up activities before exercise are significant because they increase the excitability of the central nervous system, thereby enhancing its regulatory abilities.	Establish scientific exercise methods and engage in physical activities safely.

Table 2. Intersection of High School Biology Teaching Content with Sports Science and Health Knowledge (Based on the People's Education Press Textbook)

Core Concept	Chapter	Teaching Content	The Intersection of Sports Science and Health Knowledge	Health Education Goals
Cells are the basic units of structure and life activities in organisms.	Cells are the basic units of structure and life activities in organisms.	Cells are the basic units of structure and life activities in organisms.	Cells are the basic units of structure and life activities in organisms.	Cells are the basic units of structure and life activities in organisms.
Cells need energy and nutrients to survive and proliferate through division.	Principles and application of cellular respiration	Cellular respiration can be divided into aerobic respiration and anaerobic respiration.	The essential difference between long-distance running and sprinting is aerobic versus anaerobic exercise; muscle soreness after anaerobic exercise is caused by the accumulation of lactic acid and other metabolic products.	Choose physical activities for exercise according to individual needs, and understand the role of relaxation exercises after exercise.
Genetic information controls biological traits and is passed on from generation to generation.	Relationship between gene expression and phenotype	There are complex interactions between genes, gene expression products, and the environment, which finely regulate the traits of organisms.	The development of athletic ability also depends on genetic factors, such as how flat feet make running more likely to cause foot fatigue and injury, with poor cushioning ability.	Choose suitable and moderate physical activities based on individual physical fitness.
The structure and function of living individuals are adapted to each other, with various organs coordinating and working together to complete complex life activities and maintain homeostasis through regulation mechanisms.	Hormones and the Endocrine System	In addition to nervous regulation, there are chemical substances secreted by endocrine cells, known as hormones, that regulate bodily functions, i.e., hormonal regulation.	(1) The mechanism of action and side effects of stimulants on the body's regulation. (2) Research shows that exercise can stimulate the pituitary gland to secrete endorphins (morphine-like biochemical substances), which bring pleasure and help maintain interest in exercise.	Do not take banned substances without authorization, and master medication knowledge. Develop health awareness and maintain a lifelong positive attitude and behavior towards participating in physical exercise.

was transsexualised by the stimulant testosterone. Ask: What type of stimulant does testosterone belong to? What are the mechanisms by which it regulates the body? Analyze the reasons for the doping and the degeneration of the female athlete

in the context of Example 2 (Study of androgen secretion by the testes) in the upper part of the textbook.

Student Behaviour: Find the answer in the context of the textbook: Testosterone is a steroid hormone and belongs to the class of anabolic steroid stimulants. It regulates the body by a mechanism that mimics the hormonal regulation of the organism by testosterone produced by the testes. The drug can significantly increase muscle strength, make bones thicker, and gradually disappear female characteristics.

4.3 Projecting real life to enhance health literacy

Teacher behavior: Ask students about the reasons why stimulants are ruled as prohibited drugs.

Student behavior: Summarise why doping is ruled as a prohibited drug, including the harm caused to the physical and mental health of the doping athletes, as an exogenous hormone that breaks the homeostasis and balance of the environment in the human body and violates the spirit of sportsmanship.

Teachers' behavior: Encourage students to improve their physical fitness and sports ability with scientific and regular physical exercise and nutritionally balanced diets, and not to take or abuse prohibited drugs.

5. The implementation of health education in the secondary school biology curriculum model

Shen Liping proposed that the use of biology teaching for moral education should be implemented in the classroom as the main body of the implementation of extracurricular practical activities in the curriculum and biology school-based curriculum as 'two wings' of the one-wing two-wing curriculum model [6], the curriculum model is also applicable to the implementation of health education in secondary school biology courses. Knowledge of sports science and daily health care can be organically intervened in various teaching sessions in the classroom. It can be presented as the critical factual evidence of secondary concepts, which can be used with contextual teaching strategies to support students' construction of essential concepts. It can also be presented after students' initial cognition of biological concepts or rules, allowing them to export and apply their knowledge. In addition to regular classroom teaching, the health education value of practical biology activities and school-based programs should be noticed. Practical biology activities are one of the primary and essential learning activities in the biology curriculum [7], and they are critical to achieving the cultivation objectives of the discipline, including the cultivation objectives of health literacy. The school-based curriculum related to health education can also be closer to the learning situation and promote the overall development of students' bodies and minds according to their abilities and local conditions. Students learning life science and health literacy should be open to the classroom. Still, it should be expanded to the playground and life, and practical biology activities or school-based programs related to physical exercise and daily health care should be carried out to enable students to experience the theoretical knowledge in the biology textbooks.

To sum up, sports science is based on biology, and biology provides a theoretical basis for scientific physical exercise. With the penetration of the basic knowledge of biology, physical exercise can be more scientific and reasonable. Harvesting the effect of exercise, broadening the knowledge field of students, enhancing physical quality, and promoting the health of the human body are the common goals of primary education.

6. Conclusion

It is of great significance to infiltrate health education of sports science knowledge into middle school biology teaching. It can not only improve students' health literacy, but also promote their understanding and application of biological concepts, so as to achieve comprehensive physical and mental development. By organically combining sports science with biology teaching, the practicality of classroom teaching and students' learning interest can be effectively improved.

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